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THE FOLLOWING IS THE ENGLISH TRANSLATION OF THE
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The first cationic polymer is a copolymer of cationic and nonionic monomers.

Examples of suitable cationic monomer components are cationized esters of (meth)acrylic acid, such as dimethylaminoethyl (meth)acrylate, diethylaminoethyl (meth)acrylate, diethylaminopropyl (meth)acrylate, dimethylaminopropyl (meth)acrylate, dimethylaminobutyl (meth)acrylate, diethylaminobutyl (meth)acrylate, cationized amides of (meth)acrylic acid, such as dimethylaminoethyl (meth)acrylamide, diethylaminoethyl (meth)acrylamide, diethylaminopropyl (meth)acrylamide, dimethylaminopropyl (meth)acrylamide, dimethylaminobutyl (meth)acrylamide, diethylaminobutyl (meth)acrylamide, cationized N-alkylmonoamides and diamides with alkyl groups containing 1 to 6 C atoms, such as N-methyl(meth)acrylamide, N,N-dimethylacrylamide, N-ethyl(meth)acrylamide, N-propyl(meth)acrylamide, tert-butyl(meth)acrylamide, cationized N-vinylimidazoles as well as substituted N-vinylimidazoles, such as N-vinyl-2-methylimidazole, N-vinyl-4-methylimidazole, N-vinyl-5-methylimidazole, N-vinyl-2-ethylimidazole and cationized N-vinylimidazolines, such as vinylimidazoline, N-vinyl-2-methylimidazoline and N-vinyl-2-ethylimidazoline.

The basic monomers are used in the form neutralized with mineral acids or organic acids or in quaternized form, in which case quaternization is preferably effected with dimethyl sulfate, diethyl sulfate, methyl chloride, ethyl chloride or benzyl chloride. In a preferred embodiment, the monomers quaternized with methyl chloride or benzyl chloride are used.

Preferred cationic monomer components are the cationized esters and amides of (meth)acrylic acid, in each case containing a quaternized N atom.

hydrogen peroxide and its salts (sodium peroxide, barium peroxide) or organic peroxides such as benzoyl peroxide, butyl hydroperoxide or per acids such as peracetic acid. Besides those, however, other oxidizing agents can also be used, such as potassium permanganate, sodium and potassium chlorate, potassium dichromate, etc. As reducing agents there can be used sulfur-containing compounds such as sulfites, thiosulfates, sulfinic acid, organic thiols (ethylmercaptan, 2-hydroxyethanethiol, 2-mercaptoethylammonium chloride, thioglycolic acid) and others. In addition, ascorbic acid and low-valency metal salts are possible [copper (I); manganese (II); iron (II)]. It is also entirely possible to use phosphorus compounds, such as sodium hypophosphite. In the case of photopolymerization, the reaction is preferably started with UV light, which causes decomposition of the initiator. As examples, benzoin and benzoin derivatives, such as benzoin ether, benzil and its derivatives, such as benzil ketals, acryldiazonium salts, azo initiators such as 2,2'-azobis(isobutyronitrile), 2,2'-azobis(2-amidinopropane) hydrochloride or acetophenone derivatives can be used as initiators. The quantity of the oxidizing and reducing components ranges between 0.00005 and 0.5 wt%, preferably from 0.001 to 0.1 wt%, and that of photoinitiators ranges between 0.001 and 0.1 wt%, preferably 0.002 to 0.05 wt%, relative to the monomer solution.

The polymerization is carried out in aqueous solution, in batches in a polymerization vessel or continuously on an endless belt, as is described, for example, in DE 3544770. The process is carried out at atmospheric pressure without external supply of heat, a maximum final temperature of 50 to 150°C, depending on the concentration of polymerizable substance, being reached due to the heat of polymerization.

According to this inventive polymerization procedure, there are obtained polymers with decisively better product properties than were measured for products according to EP 262945, which products were synthesized by isothermal polymerization.

After the end of polymerization, the polymer existing as a gel is subjected to size reduction in standard industrial apparatus. The ratio of the second to the first cationic

Determination of the viscosity of the polymer

The viscosities were determined with a Brookfield viscometer on a 0.5 wt% solution in 10 wt% NaCl solution. The dissolution time was one hour.

The following abbreviations are used:

ABAH:	2,2'-azobis(2-amidinopropane) hydrochloride
DIMAPA-quat:	3-dimethylammoniumpropyl (meth)acrylamide, which has been quaternized with methyl chloride
ADAME-quat:	2-dimethylammoniummethyl (meth)acrylate, which has been quaternized with methyl chloride
DADMAC	diallyldimethylammonium chloride

Second cationic polymer

The second cationic polymers used in the examples are solution polymers of DADMAC and DIMAPA-quat, which were produced with various polymer contents and various molecular weights (M_w according to GPC). The properties of these products are listed in more detail in the table:

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Claims

1. A powdery, water-soluble, cationic polymer composition that contains at least two cationic polymers of different composition in the cationic groups, wherein a first cationic polymer is formed by radical polymerization of its monomer constituents in the presence of a second cationic polymer in aqueous solution,

characterized in that

- the polymerization of the first cationic polymer takes place in an aqueous solution of the second cationic polymer according to the method of adiabatic gel polymerization and
- the ratio of the second to the first cationic polymer lies between 0.01:10 and 1:4.

2. A composition according to claim 1, characterized in that the first cationic polymer has a weight-average molecular weight higher than 1 million.

3. A composition according to claim 1 and 2, characterized in that the second cationic polymer has a weight-average molecular weight lower than 1 million.

4. A composition according to claim 1 to 2, characterized in that the first cationic polymer is formed using cationic monomers selected from the group of cationized esters and amides of (meth)acrylic acid, in each case containing a quaternized N atom, preferably quaternized dimethylaminopropylacrylamide and quaternized dimethylaminoethyl acrylate.

5. A composition according to claim 1, and 3, characterized in that the second cationic polymer is formed using cationic monomers selected from the group comprising diallyldimethylammonium chloride and the cationized esters and amides of (meth)acrylic acid, in each case containing a quaternized N atom, preferably quaternized dimethylaminopropylacrylamide,

quaternized dimethylaminoethyl acrylate and/or diallyldimethylammonium chloride.

6. A composition according to claim 4 and 5, characterized in that copolymerized with further, nonionic water-soluble monomers, preferably with acrylamide.

7. A composition according to claim 1 to 6, characterized in that the first cationic polymer is composed of 20 to 90 wt% of cationic monomers.

8. A composition according to claim 1 to 7, characterized in that the second cationic polymer is composed of 70 to 100 wt% of cationic monomers.

9. A composition according to claim 1 to 6, characterized in that the first cationic polymer has a lower charge density than the second cationic polymer.

10. A method for producing polymer compositions according to claim 1 to 9, which polymers contain at least two cationic polymers of different composition in the cationic groups, wherein a first cationic polymer is subjected to radical polymerization by adiabatic gel polymerization of its monomer constituents in the presence of a second cationic polymer in aqueous solution and the ratio of the second to the first cationic polymer lies between 0.01:10 and 1:4,

characterized in that

- the aqueous solution of cationic monomers and the second cationic polymer is prepared with a concentration of 10 to 60 wt%, the start temperature for the polymerization is adjusted to a range of -10°C to 25°C, and oxygen is purged by an inert gas,
- the exothermic polymerization reaction of the monomers is started by addition of a

polymerization initiator, and heating of the polymerization mixture takes place with formation of a polymer gel up to its maximum temperature,
- after the maximum temperature has been reached, the polymer gel is subjected to mechanical size reduction and to drying.

11. A method according to claim 10, characterized in that the start temperature of polymerization is adjusted to a range of 0°C to 15°C,

12. A method according to claim 10 and 11, characterized in that the concentration of the aqueous solution of monomers and the second cationic polymer is 15 to 50 wt%.

13. A method according to claim 10 to 12, characterized in that the polymerization initiator comprises a redox system or a system that can be activated by UV radiation.

14. A method according to claim 10 to 13, characterized in that the polymerization is carried out on a polymerization belt.

15. A method according to claim 10 to 14, characterized in that, after size reduction, the aqueous polymer gel is dried at temperatures of 80°C to 120°C to a moisture content of less than or equal to 12.

16. The use of the polymers according to claim 1 to 9 as flocculation auxiliaries for solid/liquid separation.

17. The use according to claim 16 for purification of wastewaters and for conditioning of potable water.

18. The use according to claim 16 during paper manufacture.